

What Is Claimed Is:

1 1. A method for performing remote network management over an
2 Ethernet connection between a local node and a remote node, wherein the
3 Ethernet connection uses x -bit/ y -bit (x B/ y B) encoding, the method comprising:
4 accepting a local Ethernet bit stream containing x -bit words at the local
5 node;
6 forming a second bit stream which carries network control/management
7 information;
8 selectively encoding the x -bit words from the local Ethernet bit stream into
9 y -bit words according to the bits from the second bit stream, thereby forming a
10 third bit stream comprising y -bit words, wherein the third bit stream carries both
11 information from the Ethernet bit stream and information from the second bit
12 stream; and
13 transmitting the third bit stream on a physical medium from the local node
14 to the remote node.

1 2. The method of claim 1, wherein forming the second bit stream
2 involves time-division multiplexing a control channel and a number of constant
3 bit-rate communication channels; and
4 wherein the method further comprises terminating the constant bit-rate
5 communication channels with local line interface units (LIUs) located within the
6 local node and with remote LIUs located within the remote node.

1 3. The method of claim 2, wherein time-division multiplexing the
2 number of constant bit-rate communication channels involves time-division
3 multiplexing a number of T1, E1, or DS3 channels.

1 4. The method of claim 2, further comprising storing control
2 information in a local register located within the local node;
3 whereby the local register can collect information from, and can issue
4 commands to, the local LIUs through at least one serial peripheral interface (SPI);
5 whereby information stored in the local register can be extracted and
6 transmitted through the control channel to the remote node; and
7 whereby information stored in the local register can be updated with
8 information received through the control channel.

1 5. The method of claim 4, further comprising storing control
2 information in a remote register located within the remote node;
3 whereby the remote register can collect information from, and can issue
4 commands to, the remote LIUs through at least one SPI;
5 whereby information stored in the remote register can be extracted and
6 transmitted through the control channel to the local node; and
7 whereby information stored in the remote register can be updated with
8 information received through the control channel.

1 6. The method of claim 4, further comprising controlling the remote
2 LIUs with a local control processor which can access the local register through an
3 SPI;
4 wherein the local control processor writes commands to be communicated
5 to the remote LIUs in the local register; and
6 wherein the local control processor collects information which is received
7 through the control channel and which is subsequently stored in the local register.

1 7. The method of claim 4, further comprising controlling the remote
2 LIUs by issuing control commands stored in an erasable programmable read-only
3 memory (EPROM) located within the local node;
4 wherein the control commands are first transferred to the local register
5 prior to being transmitted to the remote node.

1 8. The method of claim 1, wherein the Ethernet connection is a
2 100Base Ethernet connection, and wherein forming the third bit stream involves
3 encoding 4-bit words into 5-bit words according to the second bit stream.

1 9. The method of claim 1, wherein the Ethernet connection is a
2 100Base Ethernet connection, and wherein forming the third bit stream involves
3 encoding 8-bit words into 10-bit words according to the second bit stream.

1 10. The method of claim 1, wherein the Ethernet connection is a
2 1000Base Ethernet connection, and wherein forming the third bit stream involves
3 encoding 8-bit words into 10-bit words according to the second bit stream.

1 11. The method of claim 1, further comprising detecting whether the
2 remote node has xB/yB demultiplexing capability through which the remote node
3 can extract the encoded second bit stream.

1 12. The method of claim 1, wherein forming the second bit stream
2 involves including data-error status, alarm conditions, loss-of-synchronization
3 signals, or instructions to configure an LIU within the second bit stream.

1 13. An apparatus that performs remote network management over an
2 Ethernet connection between a local node and a remote node, wherein the
3 Ethernet connection uses x -bit/ y -bit (x B/ y B) encoding, the apparatus comprising:
4 a receiving mechanism configured to accept a local Ethernet bit stream
5 containing x -bit words at the local node;
6 a multiplexing mechanism configured to form a second bit stream which
7 carries network control/management information;
8 an encoder configured to selectively encode the x -bit words from the local
9 Ethernet bit stream into y -bit words according to the bits from the second bit
10 stream, thereby forming a third bit stream comprising y -bit words, wherein the
11 third bit stream carries both information from the Ethernet bit stream and
12 information from the second bit stream; and
13 a transmitting mechanism configured to transmit the third bit stream on a
14 physical medium from the local node to the remote node.

1 14. The apparatus of claim 13, wherein while forming the second bit
2 the encoder is configured to time-division multiplex a control channel and a
3 number of constant bit-rate communication channels; and
4 wherein the local node further includes local LIUs located for terminating
5 the constant bit-rate communication channels at the local node, and wherein the
6 remote node further includes with remote LIUs located for terminating the
7 constant bit-rate communication channels at the remote node.

1 15. The apparatus of claim 14, wherein while time-division
2 multiplexing the number of constant bit-rate communication channels the encoder
3 is configured to time-division multiplexing a number of T1, E1, or DS3 channels.

1 16. The apparatus of claim 14, further comprising a local register
2 located within the local node for storing control information;
3 whereby the local register can collect information from, and can issue
4 commands to, the local LIUs through at least one SPI;
5 whereby information stored in the local register can be extracted and
6 transmitted through the control channel to the remote node; and
7 whereby information stored in the local register can be updated with
8 information received through the control channel.

1 17. The apparatus of claim 16, further comprising a remoted register
2 located within the remote node for storing control information;
3 whereby the remote register can collect information from, and can issue
4 commands to, the remote LIUs through at least one SPI;
5 whereby information stored in the remote register can be extracted and
6 transmitted through the control channel to the local node; and
7 whereby information stored in the remote register can be updated with
8 information received through the control channel.

1 18. The apparatus of claim 16, further comprising a local control
2 processor, wherein the local control processor is configured to:
3 access the local register though an SPI;
4 control the remote LIUs;
5 write commands to be communicated to the remote LIUs in the local
6 register; and to
7 collect information which is received through the control channel and
8 which is subsequently stored in the local register.

1 19. The apparatus of claim 16, further comprising an EPROM located
2 within the local node which stores control commands that can be issued to control
3 the remote node, wherein the control commands are first transferred to the local
4 register prior to being transmitted to the remote node.

1 20. The apparatus of claim 13, wherein the Ethernet connection is a
2 100Base Ethernet connection, and wherein while forming the third bit stream the
3 encoder is configured to encode 4-bit words into 5-bit words according to the
4 second bit stream.

1 21. The apparatus of claim 13, wherein the Ethernet connection is a
2 100Base Ethernet connection, and wherein while forming the third bit stream the
3 encoder is configured to encode 8-bit words into 10-bit words according to the
4 second bit stream.

1 22. The apparatus of claim 13, wherein the Ethernet connection is a
2 1000Base Ethernet connection, and wherein while forming the third bit stream the
3 encoder is configured to encode 8-bit words into 10-bit words according to the
4 second bit stream.

1 23. The apparatus of claim 13, further comprising an auto-sensing
2 mechanism configured to detect whether the remote node has xB/yB
3 demultiplexing capability through which the remote node can extract the encoded
4 second bit stream.

1 24. The apparatus of claim 13, wherein the multiplexing mechanism is
2 configured to include data-error status, alarm conditions, loss-of-synchronization
3 signals, or instructions to configure an LIU within the second bit stream.

1 25. A computer-readable storage medium storing instructions that
2 when executed by a computer cause the computer to perform a method for remote
3 network management over an Ethernet connection between a local node and a
4 remote node, wherein the Ethernet connection uses x -bit/ y -bit (x B/ y B) encoding,
5 the method comprising:
6 accepting a local Ethernet bit stream containing x -bit words at the local
7 node;
8 forming a second bit stream which carries network control/management
9 information;
10 selectively encoding the x -bit words from the local Ethernet bit stream into
11 y -bit words according to the bits from the second bit stream, thereby forming a
12 third bit stream comprising y -bit words, wherein the third bit stream carries both
13 information from the Ethernet bit stream and information from the second bit
14 stream; and
15 transmitting the third bit stream on a physical medium from the local node
16 to the remote node.

1 26. The computer-readable storage medium of claim 25, wherein
2 forming the second bit stream involves time-division multiplexing a control
3 channel and a number of constant bit-rate communication channels; and
4 wherein the method further comprises terminating the constant bit-rate
5 communication channels with local LIUs located within the local node and with
6 remote LIUs located within the remote node.

1 27. The computer-readable storage medium of claim 26, wherein time-
2 division multiplexing the number of constant bit-rate communication channels
3 involves time-division multiplexing a number of T1, E1, or DS3 channels.

1 28. The computer-readable storage medium of claim 26, where in the
2 method further comprises storing control information in a local register located
3 within the local node;

4 whereby the local register can collect information from, and can issue
5 commands to, the local LIUs through at least one SPI;

6 whereby information stored in the local register can be extracted and
7 transmitted through the control channel to the remote node; and

8 whereby information stored in the local register can be updated with
9 information received through the control channel.

1 29. The computer-readable storage medium of claim 28, wherein the
2 method further comprises storing control information in a remote register located
3 within the remote node;

4 whereby the remote register can collect information from, and can issue
5 commands to, the remote LIUs through at least one SPI;

6 whereby information stored in the remote register can be extracted and
7 transmitted through the control channel to the local node; and

8 whereby information stored in the remote register can be updated with
9 information received through the control channel.

1 30. The computer-readable storage medium of claim 28, wherein the
2 method further comprises controlling the remote LIUs with a local control
3 processor which can access the local register through an SPI;

4 wherein the local control processor writes commands to be communicated
5 to the remote LIUs in the local register; and
6 wherein the local control processor collects information which is received
7 through the control channel and which is subsequently stored in the local register.

1 31. The computer-readable storage medium of claim 28, wherein the
2 method further comprises controlling the remote LIUs by issuing control
3 commands stored in an erasable programmable read-only memory (EPROM)
4 located within the local node;

5 wherein the control commands are first transferred to the local register
6 prior to being transmitted to the remote node.

1 32. The computer-readable storage medium of claim 25, wherein the
2 Ethernet connection is a 100Base Ethernet connection, and wherein forming the
3 third bit stream involves encoding 4-bit words into 5-bit words according to the
4 second bit stream.

1 33. The computer-readable storage medium of claim 25, wherein the
2 Ethernet connection is a 100Base Ethernet connection, and wherein forming the
3 third bit stream involves encoding 8-bit words into 10-bit words according to the
4 second bit stream.

1 34. The computer-readable storage medium of claim 25, wherein the
2 Ethernet connection is a 1000Base Ethernet connection, and wherein forming the
3 third bit stream involves encoding 8-bit words into 10-bit words according to the
4 second bit stream.

1 35. The computer-readable storage medium of claim 25, wherein the
2 method further comprises detecting whether the remote node has xB/yB
3 demultiplexing capability through which the remote node can extract the encoded
4 second bit stream.

1 36. The computer-readable storage medium of claim 25, wherein
2 forming the second bit stream involves including data-error status, alarm
3 conditions, loss-of-synchronization signals, or instructions to configure an LIU
4 within the second bit stream.